Geometry Go Getters:
Comparing Two- and Three - Dimensional Figures

Brief Overview:

In this geometric unit students will be exposed to two- and three-dimensional figures. Students will learn how to classify and identify properties of those figures in order to compare and contrast them.

NCTM Content Standard/National Science Education Standard:

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids.

Grade/Level:

Grade 5

Duration/Length:

Three lessons - 60 minutes each

Student Outcomes:

Students will:

- Analyze the properties of two-dimensional geometric figures
- Analyze the properties of three-dimensional geometric figures
- Analyze the relationship between two-dimensional and three-dimensional geometric figures.

Materials and Resources:

- Geoboards
- Rubber bands
- Brown Paper Bags
- Set of Polygons
- Straws (Flexi Straws)
- Scissors
- Glue
- Poster Board
- Markers or crayons

- Construction Paper
- Modeling clay

Development/Procedures:

Lesson 1

Pre-assessment

Students will receive a concept map of two-dimensional figures. In order to pre-assess their prior knowledge, the concept map will have several missing portions. The students will be required to complete the missing portions. **(Student and Teacher Resource 1)**

Launch

Students will work with a partner in order to identify various polygons. Several different polygons will be placed in brown paper bags. Partner 1, without looking, feels the polygons within the bag, then draws a picture of the figures they feel. Partner 2, does the same. Once both partners have completed their drawings, they compare the drawings with each other. While comparing their drawings, students will discuss how they decided what to draw, discussing things such as: number of vertices and sides.

Teacher Facilitation

Introduce and model characteristics of two-dimensional figures, including a review of properties of angles.
- Review ways to identify two-dimensional figures through vocabulary concepts.
- Facilitate groups of four students as they create three-pocket foldables using the relevant vocabulary. **(See Student and Teacher Resource 2)**
- Vocabulary: polygon, side, vertex, triangle, scalene triangle, isosceles triangle, right triangle, quadrilateral, rhombus, parallelogram, square, rectangle, pentagon, hexagon, octagon, regular polygon

Student Application

Students will determine various polygon's angles and sides with the use of geoboards. **(See Student and Teacher Resource 3)**
- Students will complete an activity using the geoboards in groups of four.
- Each group will receive 3 geoboards and a list of descriptions about the various polygons.
- One student from each group will give the descriptions while the other students manipulate the rubber bands on the geoboards to determine which polygon is described.
- The student who answers correctly now reads the descriptions.
- Activity is completed when all cards are finished.

Embedded Assessment

Students will complete "Exit Slips" in order to determine each student's progress toward understanding two-dimensional figures. **(See Student and Teacher Resource 4)**

Reteaching/Extension

- Reteaching: Those students who have not fully grasped the concept of two-dimensional figures will work with a partner to create a poster of a specific polygon, such as: quadrilateral, pentagon, hexagon, etc. Students will list the number of angles and number of sides of each polygon. On the poster board, use straws to create regular and irregular versions of the specific polygon.

Lesson 2

Pre-assessment

Students will label the vertices, edges, and faces of various solids. **(See Student and Teacher Resource 5)**

Launch

Students will be given a set of nets for various solids to investigate. Students will be expected to look at the net and determine the solid it makes when folded. Students will not be allowed to fold the solid until all guesses have been made (See Student Resources 6 and 7)**.**

Teacher Facilitation

Complete an activity with the students to discover the differences and similarities when solids are viewed as a net and folded.

- Distribute a set of solids and matching nets to groups of four (See Student Resource 8).
- Students will count the vertices, edges, and faces on the nets and the set of three-dimensional figures.
- Students will compare results (See Student Resource 9).
- Students will notice that when nets are open they will have more edges and vertices but the number and type of faces stay the same.

Student Application

Students will work individually to create a graphic organizer of solid figures.

- Each student will use set of three-dimensional figures and nets to complete the graphic organizer (See Student Resource 10 and Teacher Resource 6).

Embedded Assessment

Students will complete "Exit Slips" in order to determine each student's progress toward understanding three-dimensional figures (See Student 11 and Teacher Resource 7).

Reteaching/Extension

In small groups students who have not grasped the concept will use flexi straws to recreate the solid figures. As they create the figure they will document the number or vertices, edges and faces.

- Review solids chart.
- Students will first create all the plane figures needed for a solid.
- They will connect the figures to form the solid.
- Students will label the solid figure.

Lesson 3

Pre-assessment

Review the various characteristics of two and three-dimensional figures. Students will document the figure being described on the assessment paper distributed to them (See Student 12 and Teacher Resource 8).

Launch

Students will pull random polygons out of a bag in order to create a solid figure

- Each student will take turns pulling two-dimensional figures out of a bag.
- If they name the figure, amount of vertices and edges correctly they may keep it. If not, they must place the figure back in the bag.
- They continue to pull two-dimensional figures until they can create a three-dimensional figure.
- Once everyone in the group creates a different three-dimensional figure the activity is over.

Teacher Facilitation

Serve as a facilitator as students play Geoboo. Geoboo is a geometry game that will allow children to describe different properties of two and three-dimensional figures as other children try to guess (See Teacher Resource 9).

- Review characteristics of two and three-dimensional figures with the class.
- Split the class into two teams.
- One member from each team will come up front.
- One player will be the describer and the other player will be the monitor.
- The describer will grab a card out of the bag and use no more than three descriptions to explain the figure. Describers must only use words and no motions. They are not allowed to say any word on the card. The team will only have one chance to guess the correct figure. If they do not guess correctly the card goes back in the bag.
- The other team's player is the monitor. The monitor is responsible for making sure the person describing the card does not say any words off the card. If the describer says a word form the card, the monitor will ring the bell, and the turn is over.
- The teams continue to play until all cards are finished.
- The team with the most correct guesses wins.

Student Application

Students will create two- and three-dimensional figures out of modeling clay in order to display in the classroom.

- Distribute modeling clay to each group of four.
- Students should use graphic organizers from lesson one and two in order to assist them in creating the solid figures.
- Each student will be responsible for creating and describing his/her three-dimensional figure.

Embedded Assessment

Students will complete a Venn Diagram in order to assess their understanding of the differences and similarities of two and three-dimensional figures (See Student Resource 13).

Summative Assessment:

Students will take an assessment to see if they mastered concepts taught in this unit. The assessment will consist of five selected response questions and two brief constructed response questions. The assessment will cover concepts taught throughout the three lessons such as: Properties of two-and three-dimensional shapes, labeling of the vertices, edges and faces, differences and similarities of these figures, and mastery of which two-dimensional shapes create particular three-dimensional shapes (See Student Resource 14 and Teacher Resource 10)**.**

Authors:

Tawanda DeShazior   Mary Jo Giuffrè
Rosaryville E.S.   Perrywood E.S.
Prince George's County   Prince George's County

Directions: Complete the concept map using what you know about polygons by placing the name of the polygon on the line.

Polygons

Triangle

Quadrilateral

Pentagon

Hexagon

Octagon

Equilateral **Parallelogram** **Trapezoid**

Isosceles

Irregular Hexagon

Regular Hexagon

Scalene

Rectangle **Rhombus**

Regular Pentagon **Irregular Pentagon**

Irregular Octagon **Regular Octagon**

Square
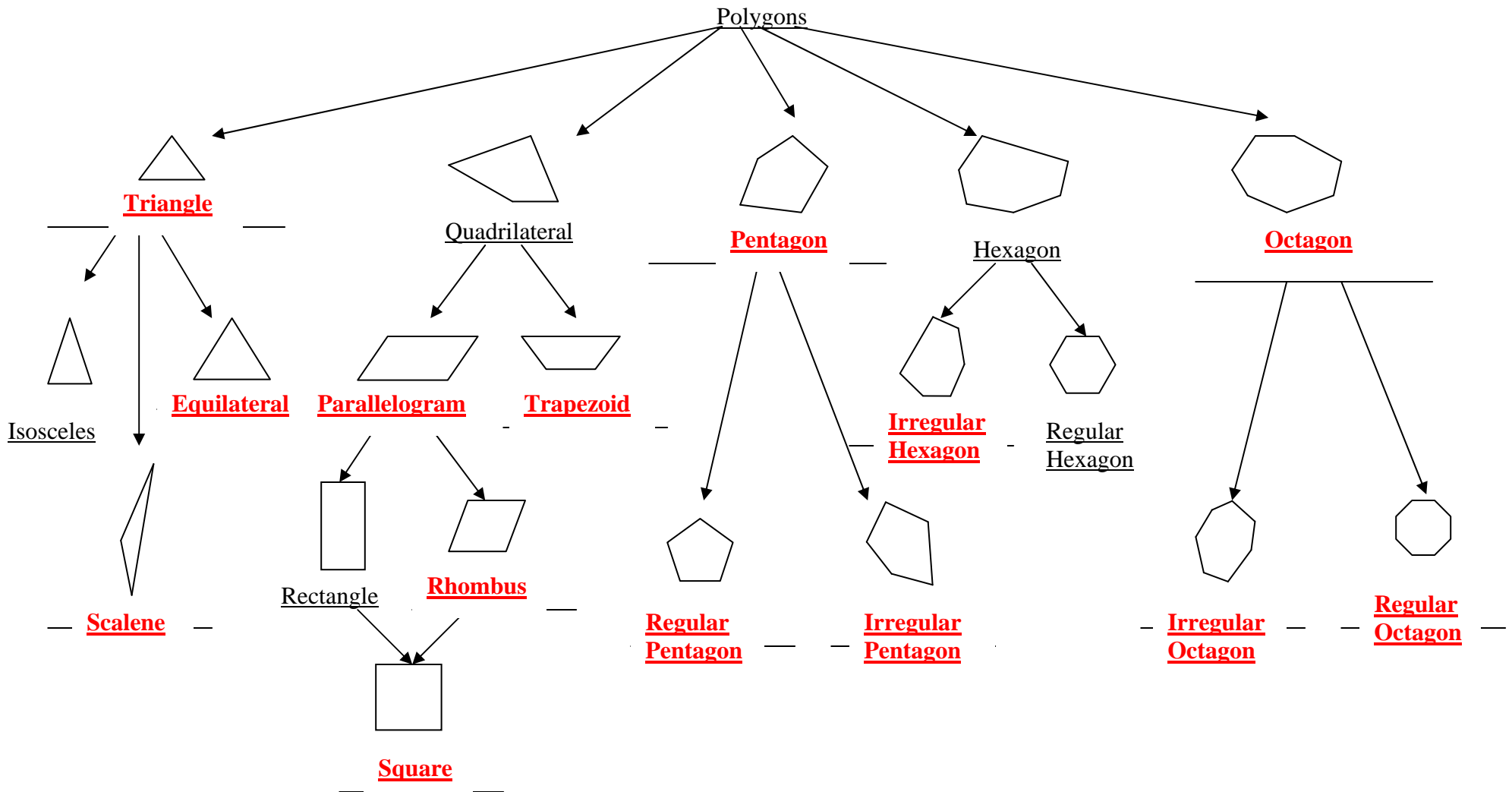
Three-Fold Foldable

Vocabulary words to look for in the students' foldables:

1. Polygon: A closed plane figure made up of line segments.

2. Side: Each of the line segments of a polygon.

3. Vertex: The point where the sides of a polygon meet.

4. Triangle: A polygon with 3 sides.

5. Scalene Triangle: A triangle in which no sides are the same length and all angles have different measurements.

6. Isosceles Triangle: A triangle that has at least two equal sides and two equal angles.

7. Right Triangle: A triangle in which there is one right angle.

8. Quadrilateral: A polygon with 4 sides.

9. Rhombus: A quadrilateral in which opposite sides are parallel and all sides are the same length.

10. Parallelogram: A quadrilateral in which both sides of opposites sides are parallel.

11. Square: A rectangle with all sides the same length.

12. Rectangle: A parallelogram with 4 right angles.

13. Pentagon: A polygon with 5 sides.

14. Hexagon: A polygon with 6 sides.

15. Octagon: A polygon with 8 sides.

16. Regular Polygon: A polygon which has sides of equal length and angles of equal measure.

Geoboard Descriptions

1. Create a figure with: **Hexagon**
   -1 right angle
   -1 acute angle
   -4 obtuse angles

2. Create a figure with: **Triangle**
   -1 right angle
   -2 acute angles

3. Create a figure with: **Quadrilateral**
   -2 right angles
   -1 acute angle
   -1 obtuse angle

4. Create a figure with: **Trapezoid**
   -1 pair of parallel sides
   -1 obtuse angle
   -2 diagonals
   -1 pair of perpendicular sides

5. Create a figure with: **Equilateral Triangle**
   -2 congruent sides
   -fewer than 2 obtuse angles
   -more than 1 line of symmetry
   -at least 1 acute angle

6. Create a figure with: **Rectangle**
   -2 lines of symmetry
   -1 pair of perpendicular lines
   -2 pair of parallel sides
   -less than 1 obtuse angle

Exit Slip	Exit Slip
Draw and label the sides, vertices, and types of angles of one polygon. **Right Triangle:** A Acute angles B C Right Angle Sides: Angles: $\overline{AB}$ < ABC $\overline{BC}$ < BCA $\overline{CA}$ < CAB	Draw and label the sides, vertices, and types of angles of one polygon.
Exit Slip	**Exit Slip**
Draw and label the sides, vertices, and types of angles of one polygon.	Draw and label the sides, vertices, and types of angles of one polygon.

Lesson 2 Pre-Assessment

Label each solid by the vertices using letters.Then list the edges and faces appropriately with the labels used.

Example:

Edges: $\overline{AB}, \overline{AC}, \overline{DF}, \overline{DE}, \overline{EF}, \overline{CB}, \overline{EC}, \overline{FB}, \overline{AD}$
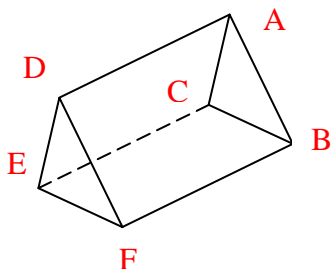
Faces: ABC, DEF, FBAD, DEAC, EFCB

Name: Triangular Prism

1.

Edges: **See Students Work**

_____

Faces: **See Students Work**

_____

Name: **Cube**

2.

Edges: **See Students Work**

_____
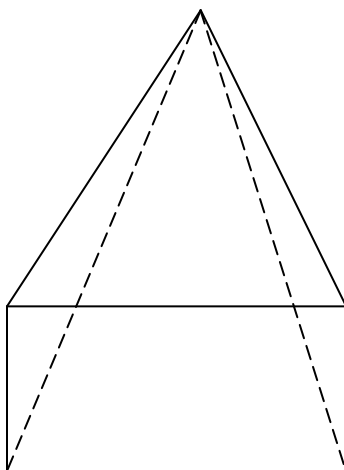
Faces: **See Students Work**

_____

Name: **Rectangular Pyramid**

Three Dimensional Figure's Chart

Figure	Number of Faces	Number of Vertices	Number of Edges	Polygon Used to Make Faces
Rectangular Prism	6	8	12	6 Rectangles
Triangular Prism	5	6	9	2 Triangles 3 Rectangles
Rectangular Pyramid	5	5	8	4Triangles 1 Rectangle
Square Pyramid	5	5	8	4Triangles 1 Square
Cube	6	8	12	5 Squares

 Exit Slip	 **Exit Slip**
Explain what you know about nets and how they are related to faces, edges, and vertices. **Student answer must include a definition of nets and an appropriate relationship to faces, edges, and vertices.**	Explain what you know about nets and how they are related to faces, edges, and vertices.
 Exit Slip	 **Exit Slip**
Explain what you know about nets and how they are related to faces, edges, and vertices.	Explain what you know about nets and how they are related to faces, edges, and vertices.
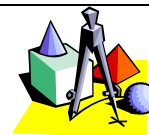
Lesson 3 Pre-assessment

Recite descriptions to students.   **Answers:**

1. Closed plane figure
   All sides congruent   **Equilateral Triangle**
   Three lines of symmetry
   Three sides

2. Three-dimensional figure
   Created from triangles and rectangles   **Rectangular Pyramid**
   Eight edges
   Five vertices

3. Three-dimensional figure
   Created from triangles and squares   **Square Pyramid**
   Same number of vertices and faces
   Eight edges

4. Two-dimensional figure
   Type of quadrilateral   **Trapezoid**
   Not all angles have the same measurement
   At least one pair of parallel lines

5. Solid figure
   Created from all the same shape   **Rectangular Pyramid**
   Not made out of squares
   Not a pyramid

GeoBoo Cards

Triangle	Quadrilateral	Vertex
• Angle • Three • Obtuse • Acute	• Parallel • Sides • Rhombus • trapezoid	• Vertices • Corner • Sides
Triangular Pyramid	**Sphere**	**Triangular Prism**
• Triangle(s) • Pyramid • Three • Solid	• Solid • Ball • Round • Circle	• Triangle • Prism • Four • Tent
Cube	**Pentagon**	**Rectangular Pyramid**
• Solid • Six • Square(s) • Edges	• Five • Plane figure • Edges • Washington D.C. • Building	• Rectangle • Pyramid • Five • Solid
Rectangular Prism	**Rhombus**	**Octagon**
• **Rectangle** • **Prism** • **Solid** • **Twelve**	• Polygon • Quadrilateral • Four • Parallel	• Stop Sign • Eight • Sides • Flat

Summative Assessment

1. Bobby is having a sleep over and wants to build a tent for his friends. It is in the shape of a triangular prism. What shapes will he need to build the tent?
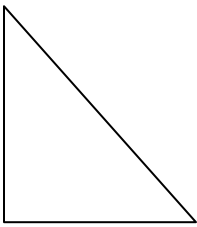A. 5 triangles
B. 2 triangles and 3 rectangles
C. 2 triangles and 4 rectangles
D. 6 rectangles

2.

Name which quadrilateral is similar to the shape above, but opposite sides and angles are congruent?
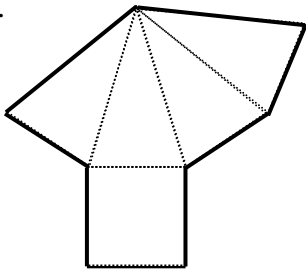A. Trapezoid
B. Rectangle
C. Rhombus
D. Parallelogram

3.
What type of triangle is shown?
A. Isosceles
B. Right
C. Obtuse
D. Equilateral

4.

Name the solid that will be formed from this net?

A. Square Pyramid
B.   Triangular Pyramid
C. Triangular Prism
D. Cone

5. Susan wants to build a flower box in her garden as shown below.

Step A
What type of three-dimensional shape could you build using this shape as one of the faces.
Sample Answers: Rectangular Prism, Rectangular Pyramid, Triangular Prism

Step B
Use what you know about three-dimensional shapes and polygons to explain your answer. Use words, numbers, and/or symbols.

See Student Answers

Directions: Complete the concept map using what you know about polygons by placing the name of the polygon on the line.
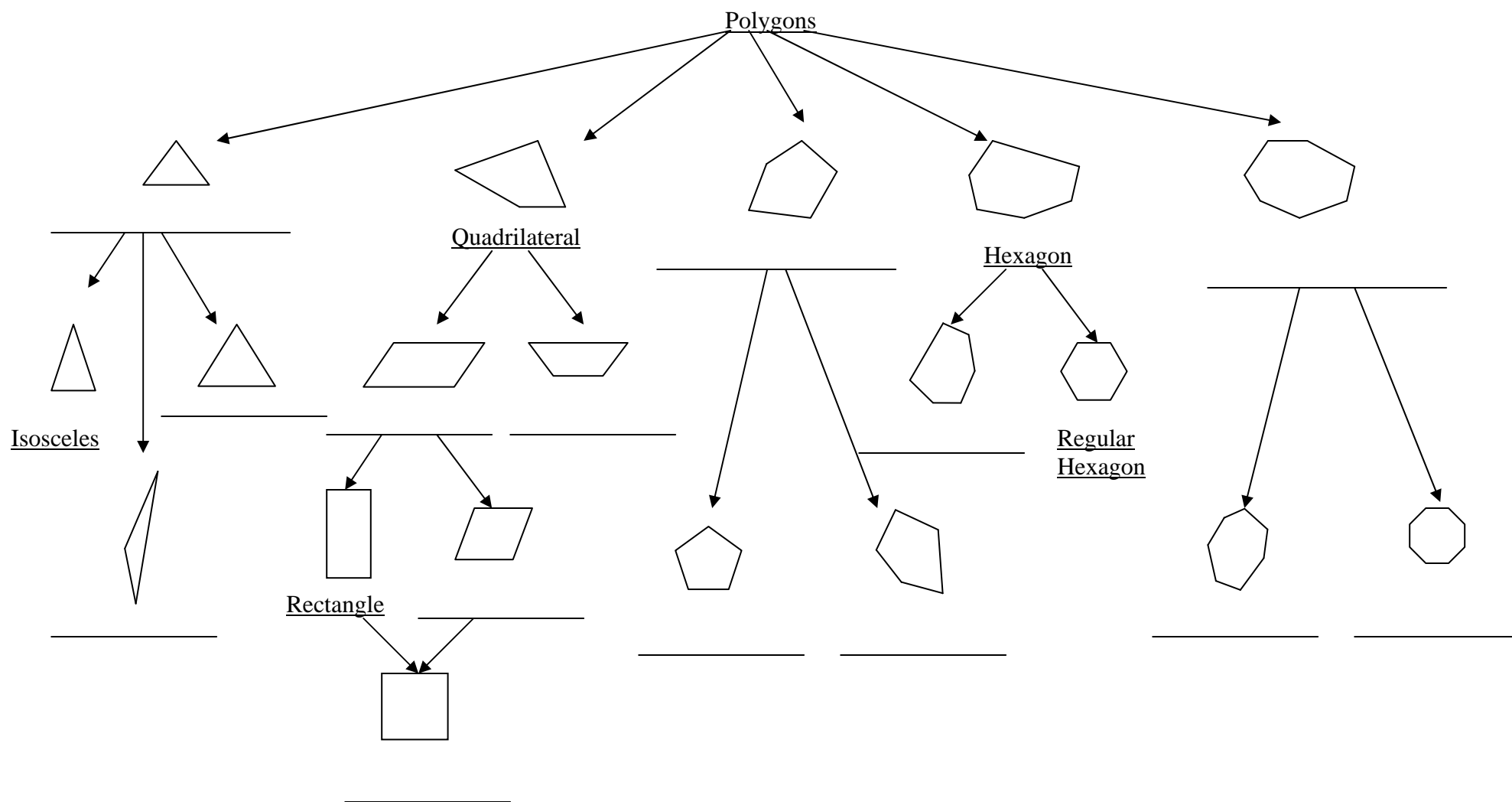
Three-Fold Foldable

Directions: 1. Fold an 8 ½" x 11" sheet of construction paper into thirds.

2. On side 1, label the top of Column 1, WORD.

3. List eight vocabulary words in Column 1.

4. In column 2, Side 1, label the top with Student Definition and write your own definition for the vocabulary listed in column 1.

5. In column 3, Side 1, label the top with Definition and look up the correct definition from your glossary and write it next to the correct vocabulary word.

6. On side 2, label the top of Column 1 as ILLUSTRATION and draw a representation of the respective vocabulary words.

7. On side 2, leave column 2 blank.

8. On side 2, label the top of Column 3 as WORD and rewrite all the vocabulary words from Column 1, Side 1 in the same order.

Ex.

Side 1 (Front)   Side 2 (Back)

| 1 | 2 | 3 | | 1 | 2 | 3 |

Side 1

Word	Student Definition	Definition
Right Triangle	A triangle with a right angle.	A triangle in which one angle is a right angle
Quadrilateral		
Hexagon		
Trapezoid		
Etc.		

Side 2

Illustration		Word
		Right Triangle
		Quadrilateral
		Hexagon
		Trapezoid
		Etc.

Geoboard Descriptions

1. Create a figure with:
    -1 right angle
    -1 acute angle
    -4 obtuse angles

2. Create a figure with:
    -1 right angle
    -2 acute angles

3. Create a figure with:
    -2 right angles
    -1 acute angle
    -1 obtuse angle

4. Create a figure with:
    -1 pair of parallel sides
    -1 obtuse angle
    -2 diagonals
    -1 pair of perpendicular sides

5. Create a figure with:
    -2 congruent sides
    -fewer than 2 obtuse angles
    -more than 1 line of symmetry
    -at least 1 acute angle

6. Create a figure with:
    -2 lines of symmetry
    -1 pair of perpendicular lines
    -2 pair of parallel sides
    -less than 1 obtuse angle

|	
Exit Slip Draw and label the sides, vertices, and types of angles of one polygon.	Exit Slip Draw and label the sides, vertices, and types of angles of one polygon.
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Lesson 2 Pre-Assessment

Label each solid by the vertices using letters. Then list the edges and faces appropriately with the labels used.

Example:

Edges: $\overline{AB}, \overline{AC}, \overline{DF}, \overline{DE}, \overline{EF}, \overline{CB}, \overline{EC}, \overline{FB}, \overline{AD}$
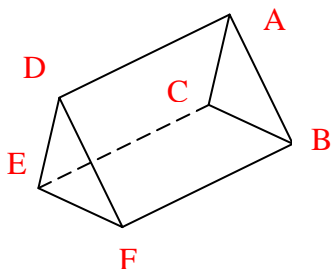
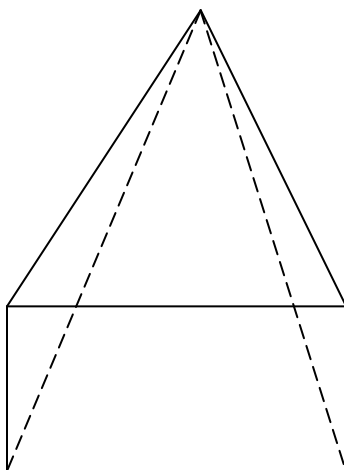Faces: ABC, DEF, FBAD, DEAC, EFCB

Name: Triangular Prism

1.

Edges: _____
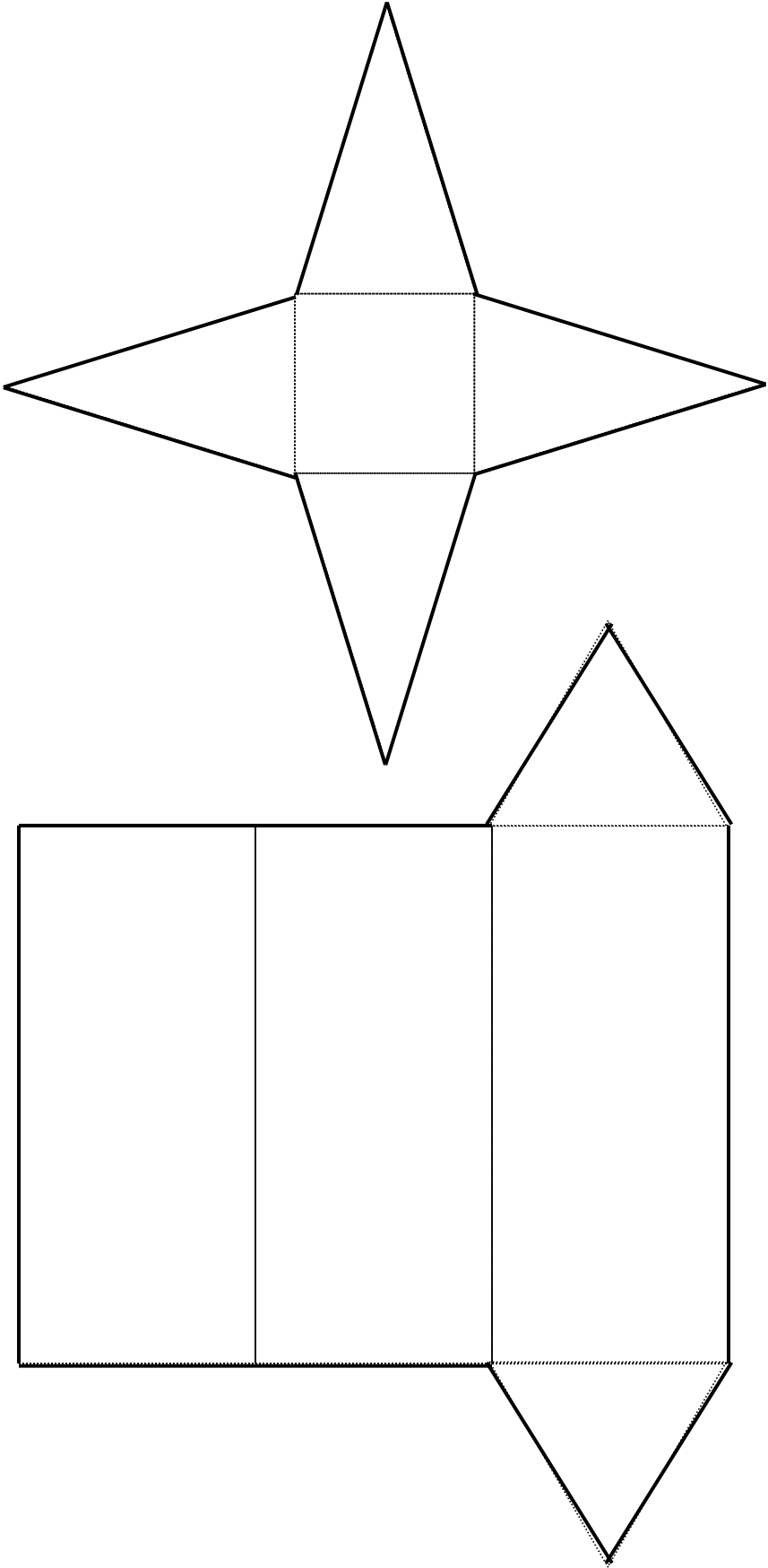
_____

Faces: _____
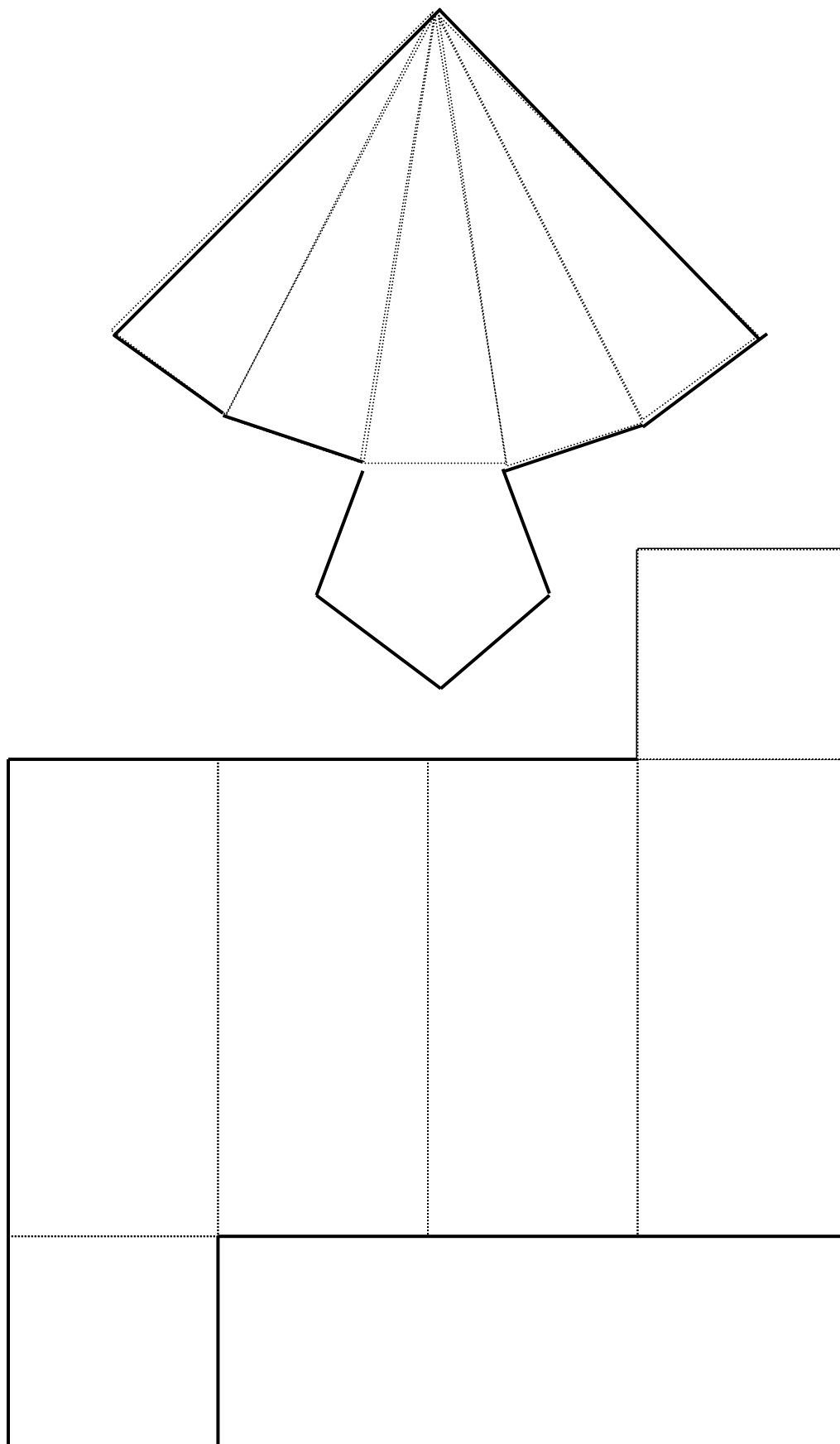
_____

Name: _____

2.

Edges: _____

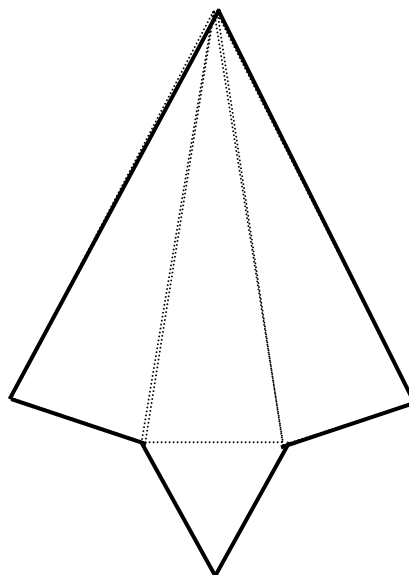_____
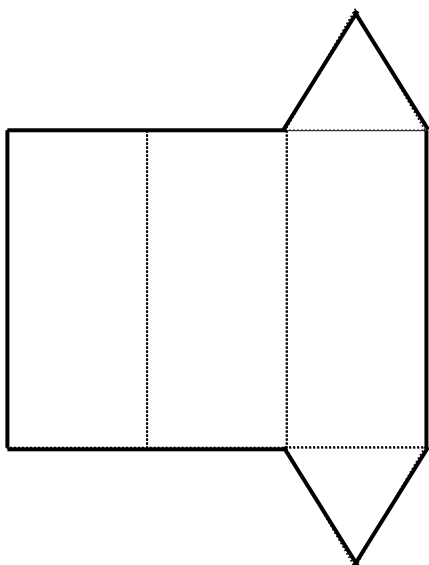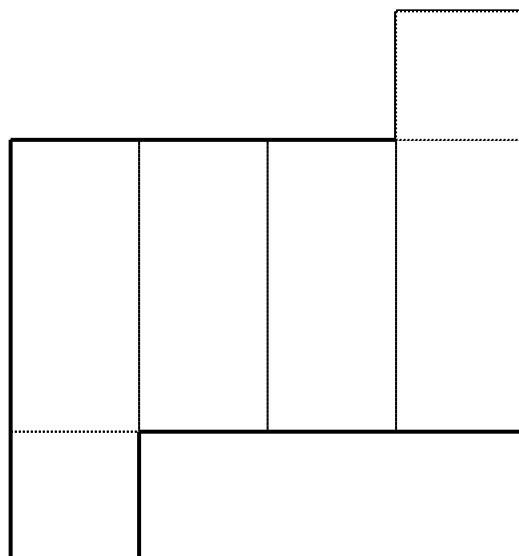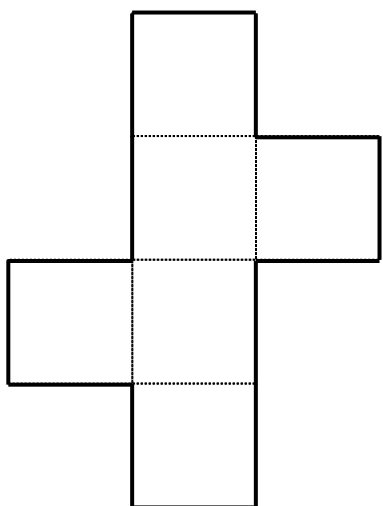
Faces: _____

_____

Name: _____

NETS

NETS

Nets
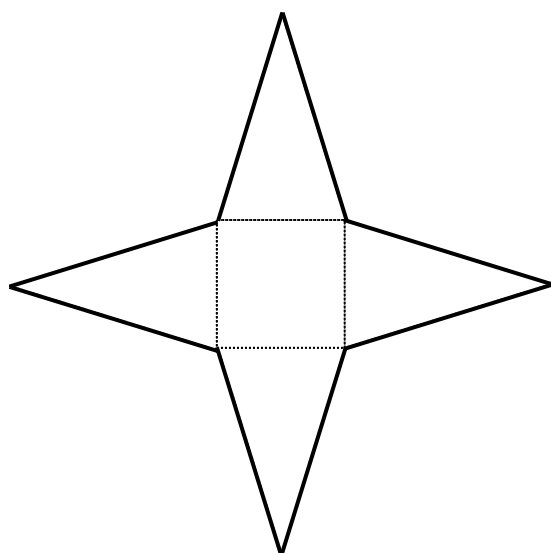
Directions: Complete the chart by counting the number of edges, vertices, and faces on each net and solid.

	NETS			SOLIDS		
3-D Figure	Number of faces	Number of edges	Number of vertices	Number of faces	Number of edges	Number of vertices

Answer the following questions:

1. How are the amount of faces edges, and vertices alike and different on each net and solid?

_____

_____

2. Why do you think the numbers are different for faces and edges on the same solid and net?

_____

_____

3. Why are the numbers the same for the number of faces on the solid and net?

_____

_____

Three Dimensional Figure's Chart

Figure	Number of Faces	Number of Vertices	Number of Edges	Polygon Used to Make Faces

Exit Slip Explain what you know about nets and how they are related to faces, edges, and vertices.	**Exit Slip** Explain what you know about nets and how they are related to faces, edges, and vertices.
Exit Slip Explain what you know about nets and how they are related to faces, edges, and vertices.	**Exit Slip** Explain what you know about nets and how they are related to faces, edges, and vertices.

Lesson 3 Pre-assessment

Answer Sheet

1. _____

2. _____

3. _____

4. _____

5. _____

Lesson 3   Student Resource 12
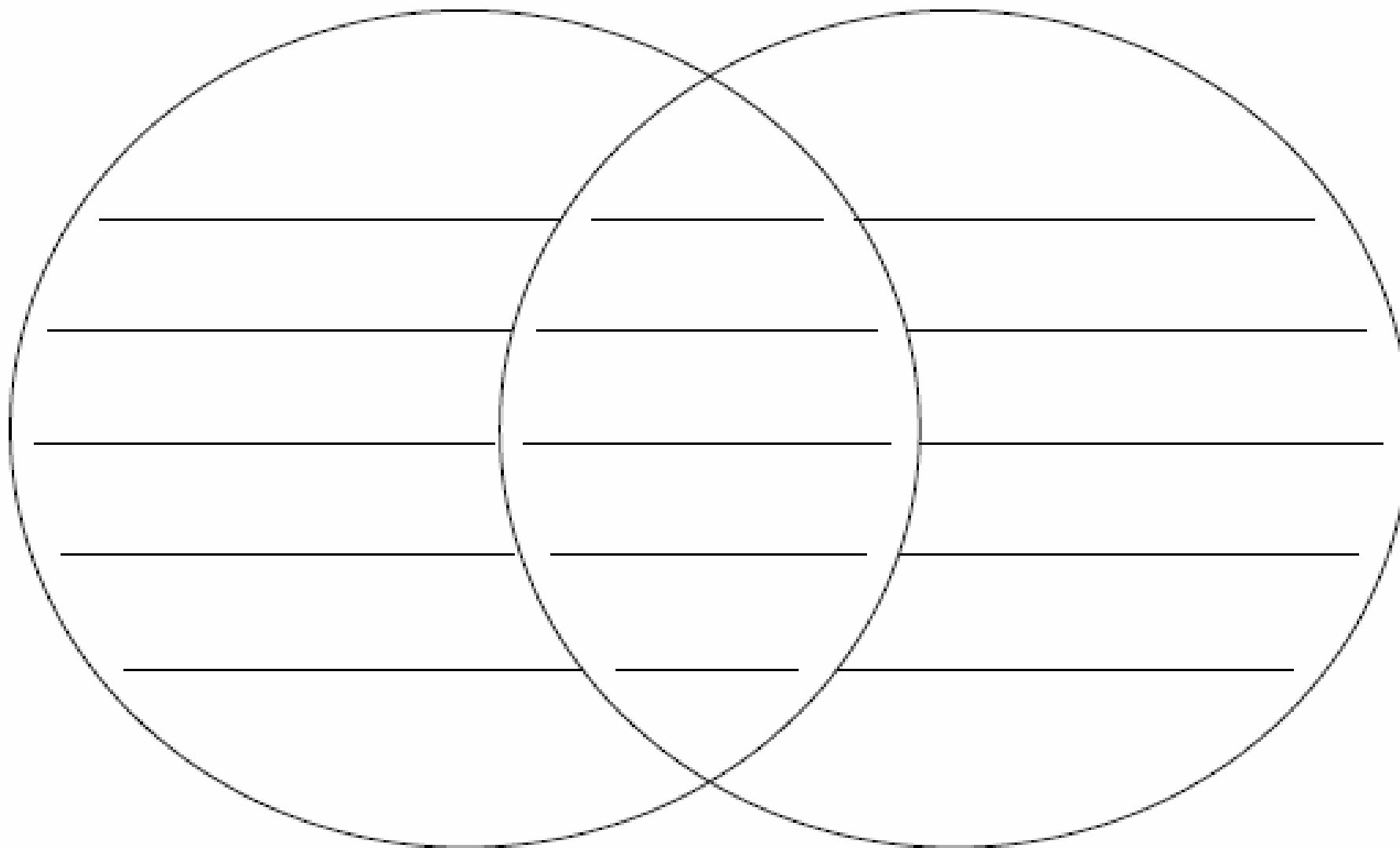Pre-assessment

Answer Sheet

1. _____

2. _____

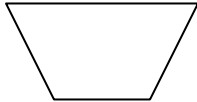3. _____

4. _____

5. _____

Venn Diagram

Summative Assessment

1. Bobby is having a sleep over and wants to build a tent for his friends. It is in the shape of a triangular prism. What shapes will he need to build the tent?
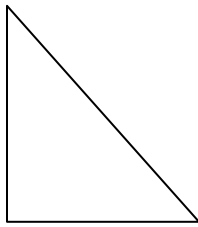A. 5 triangles
B. 2 triangles and 3 rectangles
C. 2 triangles and 4 rectangles
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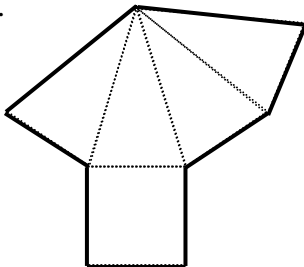A. Trapezoid
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What type of triangle is shown?
A. Isosceles
B. Right
C. Obtuse
D. Equilateral

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Name the solid that will be formed from this net?

A. Square Pyramid
B. Triangular Pyramid
C. Triangular Prism
D. Cone

5. Susan wants to build a flower box in her in her garden as shown below.

Step A

What type of three-dimensional shape could you build using this shape as one of the faces?

_____

Step B

Use what you know about three-dimensional shapes and polygons to explain your answer. Use words, numbers, and/or symbols.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____